(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
27 August 2015 (27.08.2015)

WIPO | PCT

(10) International Publication Number
WO 2015/127443 A1

(51) **International Patent Classification**:
A61M 16/04 (2006.01)

(21) **International Application Number**:
PCT/US2015/017308

(22) **International Filing Date**:
24 February 2015 (24.02.2015)

(25) **Filing Language**: English

(26) **Publication Language**: English

(30) **Priority Data**:
61/943,852 24 February 2014 (24.02.2014) US

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(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

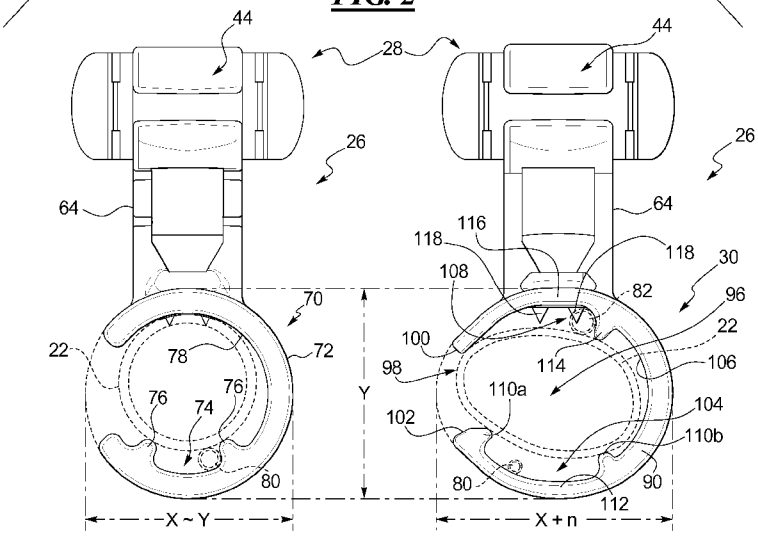
(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) **Title**: ENDOTRACHEAL TUBE BITE BLOCK

FIG. 2



(57) **Abstract**: A bite block (30) for an endotracheal tube (22) has a tubular wall with a height dimension (Y) that is smaller than a width dimension (X~Y, X+n) in cross-section or having an elliptical or oval shape in cross-section. The bite block has a first channel (104) for an accessory line on an inside surface of the tubular wall near a bottom of the bite block and has a second channel (108) for an accessory line on inside surface near a top of the bite block.

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ENDOTRACHEAL TUBE BITE BLOCK

Related Application Data

[0001] This patent is related to and claims priority benefit of U.S. provisional application Serial No. 61/943,852 filed February 24, 2014 and entitled "Endotracheal Tube Bite Block." The entire contents of this prior filed provisional application are hereby incorporated herein by reference.

Background

1. Field of the Disclosure

[0002] The present invention is generally directed to medical tube devices, and more particularly to a bite block configured to accommodate an endotracheal tube and one or more accessory lines.

2. Description of Related Art

[0003] Endotracheal (ET) tubes are commonly inserted through the mouth and into the trachea of patients under critical care. The ET tube is used to maintain an open airway for the patient to breathe and to allow mechanical assistance of breathing. ET tubes are often placed prior to surgery or are used on trauma or critically ill patients that may require intubation for extended periods of time. Many instances in which a patient is intubated require that the tube remain in place for approximately 48 to 72 hours and, in some circumstances, the period of use may be extended for 7 to 14 days or more

[0004] There are many known methods and attachment devices for securing an ET tube on a patient. One such device is manufactured and sold by Hollister, Inc., the assignee of the present patent under the name of AnchorFast®. The AnchorFast® product has a track that is secured to a patient via a head strap. The track is connected to cheek plates with cheek pads that are skin friendly and that have adhesive patches to help retain the track in the proper position on the patient's face during use. A tube holder is side-to-side adjustable on the track and is used to secure an ET tube to the device.

[0005] An earlier version of the AnchorFast® ET tube holder is disclosed in U.S. Patent No. 5,490,504 to Hollister, Inc. The '504 patent discloses a device that has the

track and tube holder, including side-to-side adjustability of the tube holder and ET tube secured thereto. However, the '504 patent does not include the cheek pads and cheek plates. Others have provided more rudimentary ET tube holding device designs. The products are sometimes as simple as a strap for the patient's head, a simple tube holding tab or bracket, and tape to secure the tube to the tab or bracket.

[0006] One problem with these and other known ET tube attachment or holding devices is that the patient may sometimes bite down hard or clamp onto the ET tube with their teeth or gums (denture wearers). This can restrict or close off the airway within the tube. Some manufacturers have developed stand-alone bite blocks that can be attached to the ET tube and be placed between the patient's teeth during use. These types of bite blocks are positioned around the ET tube and placed between the patient's teeth during use. The bite blocks are intended to protect the ET tube and inhibit crushing of the ET tube by the patient. Others have attempted to develop air assist breathing devices and even ET tube holders that incorporate a bite block function into the product. These known products are generally large, cumbersome, and complicated devices that can be difficult to manipulate and install. Medical personnel have not heretofore taken a liking to these types of integrated products.

[0007] Another problem with these types of ET tube attachment or holding devices is that the tube often is accompanied by one or more accessory lines that also pass into the patient. For example, many ET tubes have an inflation cuff on the end of the tube that is inserted into the patient. The cuff is inflated after insertion of the tube to help retain the ET tube in the patient's trachea. Typically, a pilot line is coupled to the cuff and extends along the outside of the ET tube. The pilot line routing must be taken into account so that the line is not crushed or pinched off by any part of the holding device or the ET tube. This is particularly true where a bite block function is provided. Also, a subglottic suction line is sometimes used to suction subglottic secretions in the patient's airway. The subglottic suction line typically runs adjacent the ET tube when inserted. The line must also not be crushed or pinched off.

Summary

[0008] In one example according to the teachings of the present disclosure, a bite block for an endotracheal tube has a tubular wall with a height dimension that is smaller than a width dimension in cross-section. A first channel for an accessory line

is on an inside surface of the tubular wall near a bottom of the bite block. A second channel for an accessory line is on inside surface near a top of the bite block.

[0009] In one example, the first channel can be formed between a first set of rails, which can protrude from the inside surface near a bottom of the bite block.

[0010] In one example, the second channel can be formed between a second set of rails, which can protrude from the inside surface near a top of the bite block.

[0011] In one example, the first channel can be formed adjacent at least one lengthwise protrusion that protrudes from the inside surface near a bottom of the bite block.

[0012] In one example, the second channel can be formed adjacent at least one lengthwise protrusion that protrudes from the inside surface near a top of the bite block.

[0013] In one example, the second channel can be formed by a second set of rails that protrude from an inside surface of the tubular wall and the first channel can be formed by a first set of rails that protrude from the inside surface. The second set of rails can protrude more than the first set of rails from the inside surface.

[0014] In one example, the bite block can include an insertion slot, which can be provided through the tubular wall and which can extend the entire length of the bite block.

[0015] In one example, the bite block can be a part of an endotracheal tube holder.

[0016] In one example, the bite block can be integrally formed as an integrated contiguous part of an endotracheal tube holder.

[0017] In one example according to the teachings of the present disclosure, a bite block for an endotracheal tube has a tubular wall with a generally elliptical or oval shape in cross-section. A first channel for an accessory line is formed between a first pair of protrusions spaced apart from one another, extending lengthwise along, and protruding from an inside surface near a bottom of the bite block. A second channel for an accessory line is formed between a second pair of protrusions spaced apart from one another, extending lengthwise along, and protruding from the inside surface near a top of the bite block.

[0018] In one example, the second pair of protrusions can have a height greater than a height of the first pair of protrusions from the inside surface.

[0019] In one example, the bite block can include an insertion slot, which can be provided through the tubular wall and which can extend the entire length of the bite block.

[0020] In one example, the bite block can be an integral contiguous part of an endotracheal tube holder.

[0021] In one example according to the teachings of the present disclosure, an attachment device is provided for securing an endotracheal tube on a patient. The attachment device has a portion that is configured to attach to a face of a patient. A tube holder is connected to the portion of the attachment device. A bite block has a tubular wall with a height dimension that is smaller than a width dimension in cross-section, a first channel for an accessory line on an inside surface of the tubular wall near a bottom of the bite block, and a second channel for an accessory line on inside surface near a top of the bite block.

[0022] In one example, the first channel can be formed between a first set of rails extending lengthwise along and protruding from the inside surface near a bottom of the bite block.

[0023] In one example, the second channel can be formed between a second set of rails extending lengthwise along and protruding from the inside surface near a top of the bite block.

Brief Description of the Drawings

[0024] Objects, features, and advantages of the present invention will become apparent upon reading the following description in conjunction with the drawing figures, in which:

[0025] FIG. 1 shows a front and side perspective view of one example of a device for holding or securing an endotracheal tube, the device including an integrated bite block constructed in accordance with the teachings of the present disclosure.

[0026] FIG. 2 shows an end view side-by-side comparison of a known bite block configuration (left hand side) and a bite block constructed in accordance with the teachings of the present disclosure (right hand side) such as that shown in FIG. 1.

[0027] FIG. 3 shows a side view of the tube holder and integrated bite block of the device shown in FIG. 1.

[0028] FIG. 4 shows an end view of the tube holder and integrated bite block of FIG. 3.

[0029] FIG. 5 shows a perspective view of the tube holder and integrated bite block of FIG. 3.

[0030] FIG. 6 shows a side view of another tube holder for a device such as that shown in FIG. 1, the tube holder having another example of an integrated bite block constructed in accordance with the teachings of the present disclosure.

[0031] FIG. 7 shows an end view of the tube holder and integrated bite block of FIG. 6.

Detailed Description of the Disclosure

[0032] The disclosed ET tube bite block solves or improves upon one or more of the above-noted and/or other problems and disadvantages with prior known ET tube attachment devices, ET tube holding devices, and bite blocks. In one example, the disclosed bite block can be integrated into a tube holder portion of an attachment device. In one example, the disclosed bite block can be integrally molded as a part of a tube holder for an attachment device. In one example, the disclosed bite block can accommodate one or more accessory lines, which extend within the bite block but outside of the ET tube. In one example, the disclosed bite block can inhibit the one or more accessory lines from being pinched off or crushed during use. In one example, the disclosed bite block has an oval or elliptical shape in cross-section to maintain a common height with prior known bite blocks but to accommodate both a standard ET tube diameter and a subglottic suction tube. These and other objects, features, and advantages of the present invention will become apparent to those having ordinary skill in the art upon reading this disclosure.

[0033] Turning now to the drawings, FIG. 1 shows one example of an attachment device 20 for holding and securing a tube, such as an ET tube, on a patient. Many aspects of the attachment device 20 are disclosed in detail in the aforementioned U.S. Patent No. 5,490,504. The entire content of the '504 patent is hereby incorporated by reference herein. As shown in FIG. 1, the attachment device 20 is an ET tube attachment device for securing an ET tube 20 to a patient that requires critical medical

care. The disclosed attachment device 20 generally has a track 24 that is configured to fit adjacent a lip on a patient's face. In this particular example, the track 24 is configured to rest above the patient's upper lip. However, the track 24 can also be configured to rest below a patient's lower lip in another example. In each example, however, the track 24 is intended to extend laterally or lie horizontally across a portion of the user's face.

[0034] The device 20 also generally has a tube holder 26 that is coupled to and slidable along the track 24 between the opposite ends on the track. The device 20 also has a positioning mechanism 28 that is releasably lockable to allow selective lateral repositioning of the tube holder 26, as well as an ET tube 22 that is held or secured thereby, along the track 24. The positioning mechanism 28 is also configured to retain the tube holder 26 at a selected position along the track 24. The attachment device 20 also incorporates a bite block 30 that is carried by the tube holder 26 and that is slidable therewith along the track 24. Details of the bite block 30 are described in greater detail below. The bite block 30 in this example is positioned and spaced vertically below the track 24 so that the bite block extends between the teeth within a patient's mouth during use. If the track 24 were below a patient's lower lip, the bite block 30 would be spaced vertically above the track during use.

[0035] The attachment device 20 in this example also has a cheek plate 32 connected to each of the opposite ends of the track 24. A skin friendly cheek pad 34 can be coupled to each of the cheek plates 32 on the inside face of each plate. An adhesive layer (not show) can be provided on the face contacting side 36 of each of the cheek pads 34. The adhesive layer can also be skin friendly and can help adhere the cheek plates 32 and track 24 to the patient's face during use. The cheek plates 32 and pads 34 can be curved or contoured to closely follow the curved contour of a patient's face. Each cheek plate 32 can have one or more strap loops 38 at or near their free ends. An adjustable head strap 40 can be coupled to the attachment device 20 via the strap loops 38 for securing the device to a patient's head and retaining the track 24, cheek plates 32, and cheek pads 34 on the patient's face. A separate lip pad 42 can be provided on the face contacting side of the track 24 as well. The lip pad 42 can be adhered to the track 24 and can also have a skin friendly adhesive on the rear exposed side to help retain the track in position against the patient's face during use.

[0036] As will be evident to those having ordinary skill in the art, the track 24, cheek plates 32, cheek pads 34, and head strap 40 can vary in configuration and construction and yet fall within the scope of the disclosure and the appended claims. The track 24 and cheek plates 32 can be molded as one integrated unitary or contiguous plastic structure, if desired. These components can be fabricated from any suitable material and one such material is polypropylene. The head strap 40 can be formed having any suitable adjustable fastening mechanism, such as a hook and loop structure on a fabric strap. The cheek plates 32 can be formed having any number of configurations and constructions and can utilize a minimum amount of base material (i.e., plastic). The disclosed bite block 30 can also be configured for use with other types of ET tube attachment and holder devices or can be configured as a stand-alone bite block device, as will become apparent to those having ordinary skill in the art upon reading this disclosure.

[0037] The tube holder 26 in this example generally has a shuttle 44 that is slidably mounted on the track 24. The tube holder 26 also has an arm 46 that extends in a direction perpendicular to the track 24 and in a direction away from the exposed or outer surface 48 of the track. Securement means are provided on the arm 46 for securing the ET tube 22 thereto in a direction parallel to the arm. In one example, the securement means can employ a soft, flexible, elongate tube strap 50 of an elastomeric material. One end of the tube strap 50 can have an enlarged retaining portion (not shown). A slot 54 for receiving the tube strap 50 can be formed across and through the arm 46. The tube strap 50 can be threaded through the slot 54 in either direction and the retaining portion can seat in a chamfered entry, fixing that end of the strap to the arm. A free length 56 of the tube strap 50 extends in a direction transverse to the arm 46 and can be wrapped around the ET tube 22 as shown in FIG. 1. An adhesive pad (not shown) or layer, such as a suitable pressure-sensitive adhesive, can be provided on an inner surface of the tube strap 50 to further restrain the ET tube 22 from rotational or longitudinal movement when secured against the bottom of the arm 46.

[0038] A clamping means can be provided on a top side of the arm 46, opposite the bottom side. The clamping means can be substantially similar to that disclosed in the aforementioned '504 patent, such as a clamping lever 60 and is provided for further securing the tube strap 50 in place around the ET tube 22. In this example, a latching

means can also be provided to lock and hold the clamping means in a locked or clamped condition of FIG. 1. The latching means can also be substantially similar to that disclosed in the aforementioned '504 patent, such as a flexible catch 62 to selectively hold or release the clamping lever 60. This type of latching means allows a medical technician or caregiver to release the ET tube 22, readjust its position, and then re-secure the tube again without having to replace any components, tape, and the like.

[0039] The arm 46 in this example is connected to the shuttle 44 by a flexible leg 64. The flexible leg 64 in this example can have has one or more optional relieved sections 66 that allow the leg to bend and flex so that the arm 46 can move slightly relative to the shuttle 44. Such flexibility can impart a degree of give or yield between the shuttle 44 and the arm 46 so that the track 24 can stay in position on the patient's face even while the patient's involuntary movements may cause movement of the ET tube 22 and the arm during use.

[0040] The positioning mechanism 28 in the disclosed example can also be substantially similar to that disclosed in the aforementioned '504 patent. The positioning mechanism 24 can allow selective lateral positioning of the tube holder 26 and the ET tube 22, as well as the bite block 30, along the track 24 without having to remove the attachment device 20 from the patient or the ET tube from the device. The positioning mechanism 28 can include a locking means, such as flexible tabs 66 carried on the shuttle 44 and notches or recesses 68 provided in the outer surface 48 of the track 34. The tabs 66 can seat in selected ones of the recesses 68 to position the tube holder 26 at a desired location along the track 24. Thus, the tube holder 26 and the ET tube 22 can be locked and retained in the selected position of adjustment on the track 24 during use.

[0041] As will be evident to those having ordinary skill in the art upon reading this disclosure, the disclosed attachment device 20, if used along with the disclosed bite block 30, is not to be limited to the particular tube holder construction disclosed herein. The arm, latching means, clamping means, flexible leg, track, positioning mechanism, locking means, and shuttle can vary in configuration and construction from the examples shown and described herein. The disclosed bite block 30 in one example can be integrated into an attachment device 20, such as that described above and shown in FIG. 1. However, as previously noted, the disclosed bite block 30 can

be used on other types of ET tube attachment devices and tube holder devices or can be used as a stand-alone bite block.

[0042] In one example, the disclosed bite block 30 can be integrally molded from a suitable plastic or similar material as a part of the tube holder. This can render the entire tube holder 26, including the bite block 30 as a one-piece unit, i.e., as a unitary contiguous component inclusive of the bite block, the arm 46, the shuttle 44, and the clamping mechanism for the tube strap 50. In one alternate example, the bite block 30 could be a separate element that is configured to attach to the tube holder 26. This could be done utilizing a complementary snap connection between bite block and tube holder or utilizing an adhesive, fasteners, or the like. In such an example, the bite block 30 could be utilized on a patient where the medical personnel determine such usage beneficial. The bite block 30 could also be removed in such an example if the medical personnel determined that the bite block should not be used for a given patient for some reason. In yet another example, the disclosed bite block 30 could be used as a separate stand-alone bite block not associated with any particular ET tube attachment or holding device.

[0043] FIG. 2 shows a comparison between a known or prior art bite block 70 (shown on the left hand side in FIG. 2) and one example of a bite block, i.e., the bite block 30 (shown on the right hand side in FIG. 2), constructed in accordance with the teachings of the present disclosure. The known bite block 70 on the left hand side is not designed to house and protect a subglottic suction tube (see line 80 in FIG. 1), which may very often be used or even be necessary to use in conjunction with an ET tube 22 on a patient. The known bite block 70 is round in cross-section and thus has a height Y that is substantially equal to a width X of the bite block. These dimensions refer to the outside surface 72 on the bite block 70, which is important because the patient's teeth and mouth contact the outside surface during use. The ET tube 22 is also round in cross-section and the bite block 70 interior is typically round as well. It has been known to provide a channel 74 along the bottom of the bite block 70 to accommodate an accessory line for use with the ET tube 22. The prior art bite block 70 as shown has two small ribs, protrusions, or rails 76 that are spaced apart and run lengthwise along the inside surface 78 at the bottom of the bite block 70 underneath the ET tube 22. The ribs or rails 76 create a space between the ET tube 22 and the inside surface 78 of the bite block side wall 76. This space creates the accessory

channel 74. A pilot line 80 for inflating the ET tube 22 inflatable retention cuff is run between the ribs 76 so as not to be crushed between the bite block 70 side wall and the ET tube 22 when a patient bites down on the bite block.

[0044] In the prior art bite block configurations, there is no room for a subglottic suction tube 82 (see FIG. 1), which is typically a larger diameter line or hose in comparison to the pilot line 80. However, a subglottic suction tube, when needed, would still either be run through the bite block 70 by a technician alongside the ET tube 22 or be routed external to the bite block and along the outside of the ET tube. The subglottic suction tube would then be crushed or be highly susceptible to being crushed or closed off if the patient were to bite down hard on the bite block 70. The suction tube could be crushed between the ET tube 22 and bite block side wall if running inside the bite block 70, or be crushed between the patient's teeth and the outer surface 72 of the bite block if running outside the bite block.

[0045] The disclosed bite block 30 in one example is shown on the right hand side in FIG. 2. The bite block 30 has an oval or elliptical shape in cross-section instead of having a substantially round shape. In other words, the height Y of the bite block 30 is less than the width X+n of the bite block. As discussed in more detail below, the shape of the bite block 30 is configured to accommodate a subglottic suction tube 80 routed within the bite block along with the ET tube 22.

[0046] FIGS. 3-5 show the bite block 30 in several views. In this example, the bite block 30 has a wall 90 of a tubular configuration with a height dimension Y that is smaller than a width dimension X+n in cross-section. This gives the wall 90 an elliptical- or oval-like shape as shown in FIGS. 2 and 4. The wall 90 has two open ends including a rear end 92 and a forward end 94. The forward end 94 would be outside the patient's mouth during use and the rear end 92 would be inside the patient's mouth. The two ends 92, 94 define a length of the bite block 30 and the wall 90 defines a central lengthwise axis A of the bite block. A central opening 96 extends along the length of the bite block 30.

[0047] The length, wall thickness, and tubular wall features of the bite block 30 can vary form the example shown in FIGS. 2-5. In this example, the bite block 30 has an insertion slot 98 through the wall 90 along one side. The insertion slot 98 extends along the entire length of the wall 90. The wall 90 can be formed of a suitable plastic

material so that the bite block 30 is sufficiently flexible to allow the ET tube 22 to be inserted laterally into the central opening 96 through the insertion slot 98. The flexibility of the wall 90 can allow the width of the insertion slot 98, and thus the diameter of the wall, to expand when inserting the ET tube 22 and then to spring back to the normal at rest slot width and wall diameter once the tube is fully inserted. The width of the insertion slot 98 between the adjacent upper and lower edges 100, 102 that define the slot can also vary.

[0048] In this example, the wall 90 is formed to define a first channel 104 on an inside surface 106 of the wall near a bottom of the bite block 30. The wall 90 is also formed to define a second channel 108 on the inside surface 104 near a top of the bite block 30. These accessory channels 104, 108 can be formed in a number of different ways and yet provide the intended function within the bite block 30 along the central opening 96. To illustrate, each of the channels 104, 108 is formed in a slightly different manner in this example. Each channel is not limited to the particular construction disclosed for that channel. Instead, the constructions can be reveres and used for the other channel, the same construction can be used to form each channel, or still different constructions can be used to form either or both of the channels. As noted below, additional accessory line channels can also be provided, if desired.

[0049] In this example, the first channel 104 is formed between a first set or pair of rails 110a, 110b, i.e., ribs, protrusions, or the like. The rails 110a, 110b protrude radially inward from the inside surface 106 of the wall 90 near a bottom of the bite block 30. The rails 110a, 110b create a space between the ET tube 22 and the inside surface 106 of the wall 90. This space creates the accessory channel 104. It is possible that a small channel is also formed to the outside of the rail 110b (away from the channel 104) created by the spacing between the ET tube 22 and the inside surface. However, for this disclosure, the channel 104 is defined as lying between the rails 110a, 110b. A pilot line 80 for inflating the ET tube 22 inflatable retention cuff is run between the rails 110a, 110b so as not to be crushed between the wall 90 and the ET tube 22 when a patient bites down on the bite block.

[0050] In this example, each rail 110a, 110b extends the full length of the wall 90 and is a continuous rail, as depicted in FIG. 5. However, the rails 110a, 110b can instead extend less than the full length and/or can be a plurality of spaced apart protrusions instead of a single continuous rail, if desired. Also in this example, one of

the rails 110a is positioned right at or adjacent the lower edge 102 of the insertion slot 98. The other of the rails 110b is spaced circumferentially from the one rail. In this example, the channel 104 is not centered exactly at the bottom of the bite block but instead is skewed toward the insertion slot. In contrast, the bottom channel of the prior art bite block 70 is centered at the bottom. The location of the channel 104 can be moved from the bottom location as shown, if desired. Also in this example, the wall thickness of the wall segment 112 on the wall 90 between the rails 110a, 110b and on the inside surface 106 is thinner than the wall thickness of the wall beyond the channel 104. The thinner wall segment 112 can add to the depth of the channel 104 on the inside of the bite block 30. The thinner wall segment 112 and can also increase flexibility of the wall 90 near the lower edge 102 of the insertion slot 98 to further aid in insertion and removal of the ET tube 22 to and from the central opening 96 of the bite block 30.

[0051] In the disclosed example, the second channel 108 is formed adjacent a single rail 114, i.e., a rib or protrusion that protrudes radially inward from the inside surface 106 near a top of the bite block. The rail 114 again creates a space between the ET tube 22 and the inside surface 106 of the bite block wall 90. This space creates the accessory channel 108. It is again possible that a small channel could be created on either side of the rail 114. However, in this example the channel 108 is defined as lying on the side of the rail 114 nearer the top of the bite block 30. In this example, the rail 114 is offset to one side of the direct top of the bite block 30, as depicted in FIGS. 2 and 4. The wall thickness of the wall 90 on the outside (away from the top of the bite block) is relatively thick and consistent with the wall thickness of the wall 90 aside from the channels 104, 108. In contrast, the wall thickness of a top segment 116 of the wall 90 at the top of the bite block is thinner. Also, the top segment 116 of the wall 90 has a flatter, less arcuate contour. This reduced thickness and flatter contour helps to create a deeper channel 108 adjacent the rail 114 at or near the top of the bite block 30.

[0052] In this example, the rail 114 also extends the full length of the wall 90 and is a continuous rail. However, the rail 114 can instead also extend less than the full length and/or can be a plurality of spaced apart protrusions instead of a single continuous rail, if desired. Also in this example, the channel 108 is not centered exactly at the top of the bite block 30 but instead is skewed away from the insertion

slot 98. The location of the channel 108 can be moved from the offset top location as shown, if desired. The thinner top segment 116 of the wall and the flatter contour can add to the width and depth of the channel 108 on the inside of the bite block 30. The thinner top segment 116 can also increase flexibility of the wall 90 near the upper edge 100 of the insertion slot 98 to further aid in insertion and removal of the ET tube 22 to and from the central opening 96 of the bite block 30.

[0053] In this example, the first channel 104 can be configured to accommodate the pilot line 80 beneath the ET tube 22 during use. As shown in FIG. 2, the pilot line sits neatly in the channel 104. Likewise, the second channel 108 can be configured to accommodate the subglottic suction tube 82 above the ET tube 22 during use. The suction tube 82 sits neatly in the channel 108 along with both the ET tube 22 and the pilot line 80. The second channel 108 in this example is arranged about 180° opposite to the first channel 104. As depicted in FIG. 2, adding the second channel 108 via the protruding rail 114 reduces the available vertical space within the central opening 96 of the bite block 30 for the ET tube 22. Thus, if the subglottic rail 114 or second channel 108 were added to the known bite block shown in FIG. 2 on the left hand side, either the diameter or size of the bite block would have to be increased to accommodate the same sized ET tube, the ET tube diameter would have to be decreased, or the ET tube would not fit within the bite block. If one were to use such a bite block configuration anyway with a subglottic suction tube, the ET tube 22 might pinch or close off the suction tube under normal use conditions and would surely do so when a patient bites down hard on the bite block.

[0054] For patients under critical care, it is desirable to assist in minimizing the stress placed on their muscles and joints, including to the jaw. Thus, it may be important to maintain the current, desired, and/or optimal designed oral opening Y (see FIG. 2) of a bite block, from the patient's perspective. At the same time, it may also be important to accommodate routing one or more additional accessory lines, such as the subglottic suction tube 82, other than the pilot line 80, into the patient's mouth. It is desirable to do so without increasing the bite block height but while also preventing partial or complete occlusion of the suction tube 82 or another accessory line. To address these opposing concerns, the disclosed bite block 30 has an elliptical or oval shape.

[0055] The bite block 30 can have the same height Y as a conventional known round bite block 70 so as not to change the bite block size from the patient's perspective. However, adding the second channel 108 within the bite block 30 reduces the vertical height of the central opening and thus the space available for the ET tube 22. The disclosed bite block 30 has a greater width X+n than the width X of the known round bite block 70. A conventional ET tube 22 is made of a flexible, though fairly sturdy and resilient material. Thus, the ET tube 22 can be inserted into the elliptical shaped bite block 30, which will cause the ET tube to take on a more elliptical shape, as shown in FIG. 2. The ET tube 22 will still function as intended and the bite block 30 will still provide crush resistance and protection for the ET tube as well as the pilot line 80, subglottic suction tube 82, and/or one or more other accessory lines routed along one of the channels 104 or 108. The subglottic suction tube 82 can now be run within the interior of the bite block 30 along the second channel 108 above the ET tube 22 and adjacent the rail 114. The protruding rail 114 will prevent the subglottic tube 82 from being crushed.

[0056] The overall height Y of the bite block 30 is maintained for patient comfort and the same size or diameter ET tube 22 can still be used. Only the width X+n of the bite block is increased. Thus, by changing the shape of the bite block 30 from round to elliptical or oval and by adding the second channel 108 within the bite block central opening 96, the bite block accomplishes the goal of providing room for an additional accessory line to pass through the bite block while not creating further invasive interaction with the patient.

[0057] One or more accessory line channels can be formed along the inside surface 106 of the bite block 30, in addition to the first channel 104 (pilot line channel) and second channel 108 (subglottic suction tube) disclosed herein. For example, three or more spaced apart rails can be provided to define two or more separate channels, if desired, at the top of the bite block, the bottom of the bite block, or both. Also, two or more accessory lines can be run along the same channel, if desired. A subglottic suction tube is typically much larger in diameter than the standard pilot line and, thus, the two different channels disclosed herein. The second rail 114 or a set of the second rails can be larger and protrude more than the first set of rails from the bite block inside surface. The accessory lines can be provided to meet any type of additional

function needed to treat a patient, including but certainly not limited to the pilot line and the subglottic suction tube described herein.

[0058] In the disclosed example, the bite block 30 is molded as a unitary part of and at a rear end of the arm 46. A molded joint can connect the bite block 30 to the arm 46 as in this example. The molded joint can vary in configuration and construction. The intent is for the connection to be robust and durable so that the bite block 30 remains attached to the arm 46 and as a part of the tube holder 26, as long as intended. The joint can also be positioned and configured to connect the bite block 30 to the tube holder 26 at a number of different locations on both the bite block and holder. Also in this example, the bite block 30 is positioned spaced vertically below the track 24. In other configurations, as noted above, it is possible that the bite block be positioned and spaced above the track. The positioning of the bite block 30 in this example is such that the ET tube 22 can still be retained in place by the tube strap 50 and by spikes 118 (see FIGS. 2 and 4) on the underside of the arm 46, which would still be exposed forward of the bite block 30.

[0059] The wall 90 can have a blind slot 120 on the other side of the bite block 30 opposite the insertion slot 98. The blind slot 120 can be at either end 92 or 94 (or one at both ends) of the wall 90. In this example, the blind slot 120 is relatively short and is provided at the forward end 94 of the bite block 30. The blind slot 120 can add some resilience and flexibility to the wall, as desired or needed, while also reducing the amount of base material needed to make the bite block. During use, the wall 90 can give slightly if a patient were to occasionally exert a great amount of force upon the bite block. The insertion slot 98 and the optional blind slot 120 would divert some of the load or absorb some of the energy from such a force through the wall 90 instead of directly to the patient's jaw and/or teeth.

[0060] The configuration, construction, and performance features of a bite block can vary from the bite block described above. For example, the free edges 100, 102 of the wall 90 along the insertion slot 98 on the bite block 30 can be varied in shape and contour so as to help the wall retain the generally oval or elliptical shape, even when a patient's teeth exert a substantial crushing force on the bite block during use. The upper free edge 100 could have a first contoured shape and the lower free edge 102 could have a corresponding second contoured shape configured to close against and engage the first contoured shape if a sufficient clamping force is exerted on an

outer surface of the bite block. The corners 122 at the ends 92, 94 of the upper and lower edges 100, 102 can also be contoured or rounded to aid in making it easier to insert or remove the ET tube from the bite block. The various corners 122 and edges 100, 102 can also be rounded to make the bite block more comfortable for the patient.

[0061] The wall 90 of the bite block 30 can alternatively or in addition have a groove formed along a length of the bite block and recessed into the inside surface 106. The groove can create an accessory line channel recessed into the wall in addition to using protrusions, ribs, rails, or the like to create space between the inside surface and an ET tube 22 in the bite block. The groove can be V-shaped in cross-section or can have a rounded, semispherical, or other shape as well.

[0062] A subglottic suction tube 82 may have a significantly larger diameter than a conventional pilot line and thus may require a deeper channel. When the bite block 30 is compressed during use, the height of the protrusion, i.e., the rail or rails can determine how much crush is imparted to the accessory line. The rail height can thus be varied as needed or desired for a particular application. The bite block can be configured to allow for some predetermined amount of compression of the ET tube before the free edges of the wall along the insertion slot come in contact with one another to resist further compression.

[0063] Any number of the bite block and tube holder features described above can be used alone or in combination, even though such combination is not specifically mentioned herein. Also, one or more features can also be added to any of the bite block examples disclosed herein to aid in inserting an ET tube into the insertion slot and to help prevent discomfort and irritation to the patient during use. The corners 122 at the forward end 94 and/or or the rear end 92 of the free edges 100, 102 all along the insertion slot 98 on the bite block 30 can include angled, curved, or tapered entry segments at the leading edge, trailing edge, or both, of the insertion slot. In addition, a scalloped region 124 (see FIGS. 1 and 5) can be formed at one of the corners 122 to provide more room for entry of an accessory line, such as the subglottic suction tube 82. In this example the scalloped region 124 is provided on the upper edge 100 at the forward end 94. The tapered entry segments at the corners 122 and the scalloped region 124 can make the insertion slot wider, where desired on the bite block. This can make it easier for medical personnel to spread the free edges 100, 102 in order to aid in starting to insert an ET tube 22 into the bite block 30. In

another example, the face at each end 92, 94 of the bite block 30 can be curved to form rounded curved contours, especially on the working end of the bite block that will lie within a patient's mouth. Likewise, the exposed edges of the bite block can also be smooth and curved or rounded. Such features can make the device more comfortable for a patient during use.

[0064] The disclosed ET tube attachment device 20 and/or the bite block 30 can be applied or secured on the patient with the ET tube 22 already positioned in the patient's mouth and trachea. If a temporary bite block device or tube securing device is already prepositioned about the tube, that bite block or device can be removed and the bite block 30 as described herein can be attached to the ET tube 22. If the disclosed attachment device 20 is also used, this can be done at the same time that the attachment device is attached and secured to the patient. The disclosed bite blocks can be constructed from materials and material thicknesses and with features that render the bite block sufficiently rigid to inhibit the inserted ET tube from being crushed or closed off by a patient's bite during use and yet sufficiently flexible to allow relatively easy insertion and removal of the ET tube as needed.

[0065] The wall thickness of the bite block 30 can be varied over its length, if desired, and/or can be varied around the circumference of the tubular wall, if desired. In one example, the wall opposite the insertion opening can be thinner than the top and bottom wall portions of the bite block. The thinner wall section can increase flexibility for insertion and removal of the ET tube 22.

[0066] FIGS. 6 and 7 show another example of a tube holder 128 with a modified bite block 130 constructed in accordance with the teachings of the present disclosure. In this example, the bite block 130 is again an integrated or contiguous part of the tube holder 128 but has several potential modifications to the bite block 30 discussed above. In this example, the bite block 130 has a wall with a larger scalloped region 132 and a longer blind relief slot 132. In this example, the scalloped region 132 is provided on the same corner of the wall. The blind relief slot 134 however is formed in the wall opposite the relief slot 98 and is provided in the rear end on the wall. The relief slot 134 can allow for additional flexibility in the bite block 130.

[0067] Also in this example, the wall of the bite block 130 opposite the insertion slot 98 has an expansion notch 136 or living hinge formed along the length of the bite

block. The living hinge or expansion notch 136 can be provided to add flexibility to the bite block. Flexibility may be needed to aid with ET tube insertion and/or for patient comfort by allowing some desired degree of flexibility in the bite block as a patient bites down. The bite block 130 in this example has a first channel 138 formed between two rails 140a, 140b on the bottom of the wall. The channel 138 in this example is centered at the bottom of the bite block. The bite block 130 also has a second channel 142 at the top of the bite block and formed between two rails 144a, 144b. The second channel 142 is centered at the top of the bite block 130. In this example, a top wall segment 146 between the rails 144a, 144b and a bottom wall segment 148 between the rails 140a, 140b do not have a thinner wall thickness.

[0068] In one example, the actual width dimension may only be about 0.4mm larger than the Y height dimension, which in one example can be about 12.5-13.5 mm. With reference to FIG. 2, the width of the bite block is truncated by the insertion slot. If one extrapolates the elliptical shape as shown to complete the shape, the X+n dimension would be more than 0.4 mm larger than the height Y. The X+n/Y ratio can, however, vary for a given application. The top rail or rails can also be sized to allow some compression of the subglottic suction tube 82 without it becoming closed off. In one example, the height of the second rail 114 or set of rails 144a, 144b can produce about 30% compression of the subglottic suction tube, if desired.

[0069] In the foregoing examples, the scalloped regions 124 or 132 can assist to accommodate routing of the subglottic suction tube 82, as shown in FIG. 1. The larger diameter subglottic suction tube 82 can be routed from the side, through the cut-out area or scalloped region, and into the bite block adjacent the top rail or rails. The scalloped region can help to position the subglottic suction tube out of the way and off to the side. FIG. 1 also shows the positioning of the ET tube through the central opening of the bite block and the pilot line beneath the ET tube and between the bottom rails.

[0070] Although certain ET tube attachment devices, tube holders, and bite block features, components, aspects, and methods have been described herein in accordance with the teachings of the present disclosure, the scope of coverage of this patent is not limited thereto. On the contrary, this patent covers all embodiments of the teachings of the disclosure that fairly fall within the scope of permissible equivalents.

What Is Claimed Is:

1. A bite block for an endotracheal tube, the bite block comprising:

a tubular wall having a height dimension smaller than a width dimension in cross-section;

a first channel for an accessory line on an inside surface of the tubular wall near a bottom of the bite block; and

a second channel for an accessory line on inside surface near a top of the bite block.

2. A bite block according to claim 1, wherein the first channel is formed between a first set of rails protruding from the inside surface near a bottom of the bite block.

3. A bite block according to claim 2, wherein the second channel is formed between a second set of rails protruding from the inside surface near a top of the bite block.

4. A bite block according to claim 1, wherein the second channel is formed between a second set of rails protruding from the inside surface near a top of the bite block.

5. A bite block according to claim 1, wherein the first channel is formed adjacent at least one lengthwise protrusion that protrudes from the inside surface near a bottom of the bite block.

6. A bite block according to claim 1, wherein the second channel is formed adjacent at least one lengthwise protrusion that protrudes from the inside surface near a top of the bite block.

7. A bite block according to claim 1, wherein the second channel is formed by a second set of rails that protrude from an inside surface of the tubular wall and the first channel is formed by a first set of rails that protrude from the inside surface, the second set of rails protruding more than the first set of rails from the inside surface.

8. A bite block according to claim 1, further comprising an insertion slot through the tubular wall and extending the entire length of the bite block.

9. A bite block according to claim 1, wherein the bite block is a part of an endotracheal tube holder.

10. A bite block according to claim 9, wherein the bite block is integrally formed as an integrated contiguous part of the endotracheal tube holder.

11. A bite block for an endotracheal tube comprising:

a tubular wall with a generally elliptical or oval shape in cross-section;

a first channel for an accessory line formed between a first pair of protrusions spaced apart from one another, extending lengthwise along, and protruding from an inside surface near a bottom of the bite block; and

a second channel for an accessory line formed between a second pair of protrusions spaced apart from one another, extending lengthwise along, and protruding from the inside surface near a top of the bite block.

12. A bite block according to claim 11, wherein the second pair of protrusions have a height greater than a height of the first pair of protrusions from the inside surface.

13. A bite block according to claim 11, further comprising an insertion slot through the tubular wall and extending the entire length of the bite block.

14. A bite block according to claim 11, wherein the bite block is an integral contiguous part of an endotracheal tube holder.

15. An attachment device for securing an endotracheal tube on a patient, the attachment device comprising:

a portion configured to attach to a face of a patient;

a tube holder connected to the portion of the attachment device; and

a bite block a tubular wall having a height dimension smaller than a width dimension in cross-section, a first channel for an accessory line on an inside surface of the tubular wall near a bottom of the bite block, and a second channel for an accessory line on inside surface near a top of the bite block.

16. An attachment device according to claim 15, wherein the first channel is formed between a first set of rails extending lengthwise along and protruding from the inside surface near a bottom of the bite block.

17. An attachment device according to claim 16, wherein the second channel is formed between a second set of rails extending lengthwise along and protruding from the inside surface near a top of the bite block.

18. An attachment device according to claim 15, wherein the second channel is formed between a second set of rails extending lengthwise along and protruding from the inside surface near a top of the bite block.

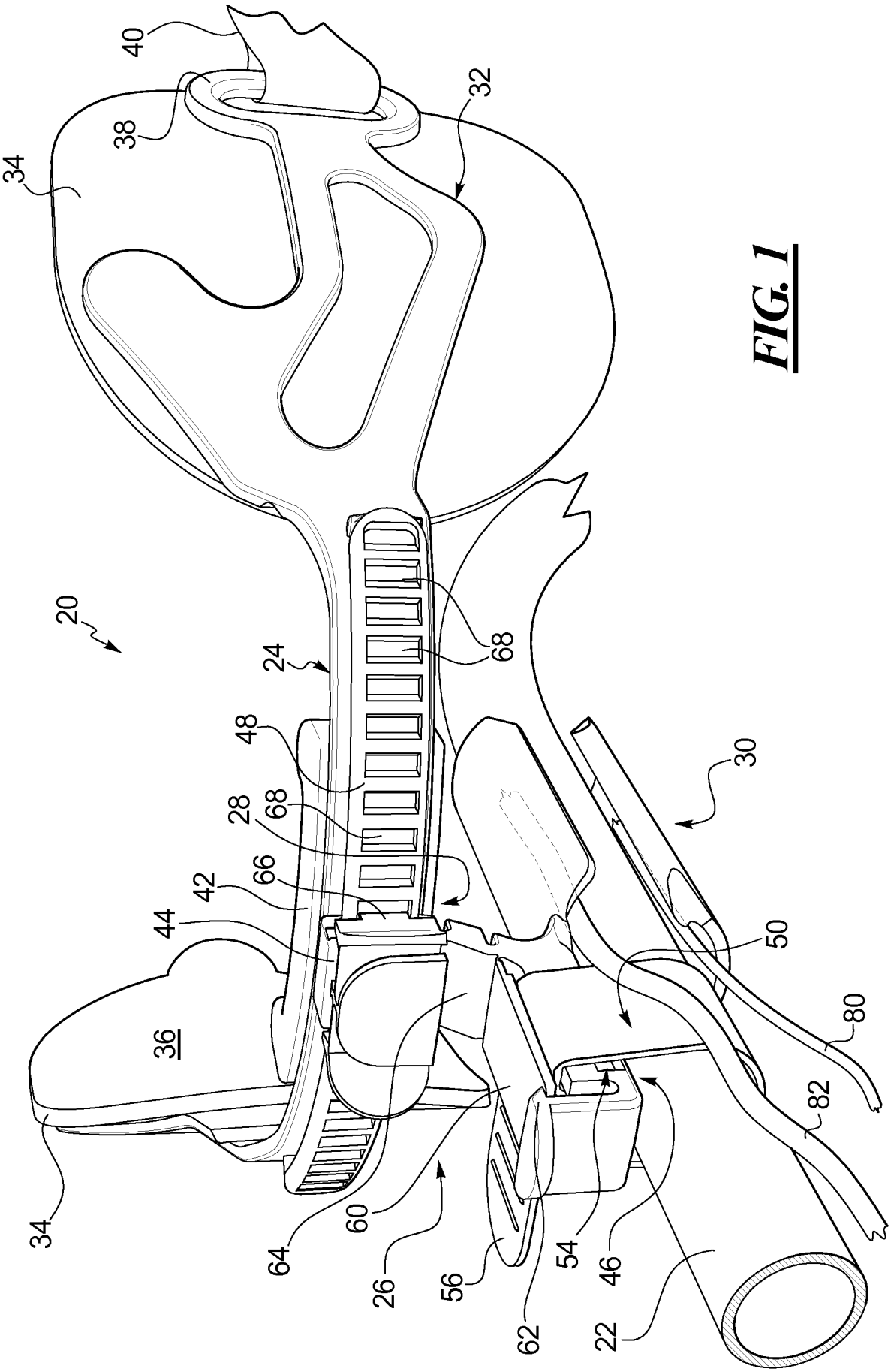
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FIG. 1

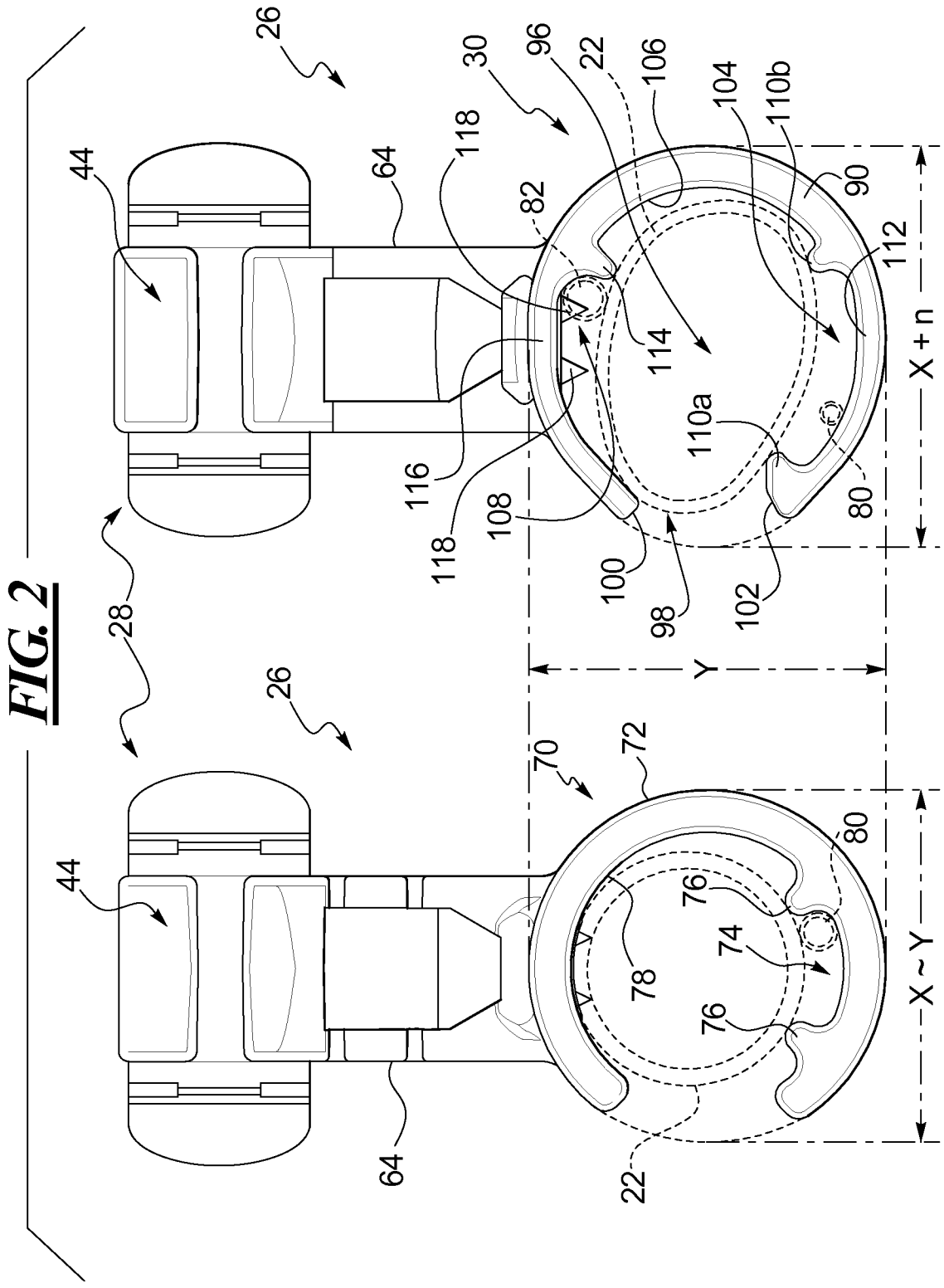
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FIG. 2

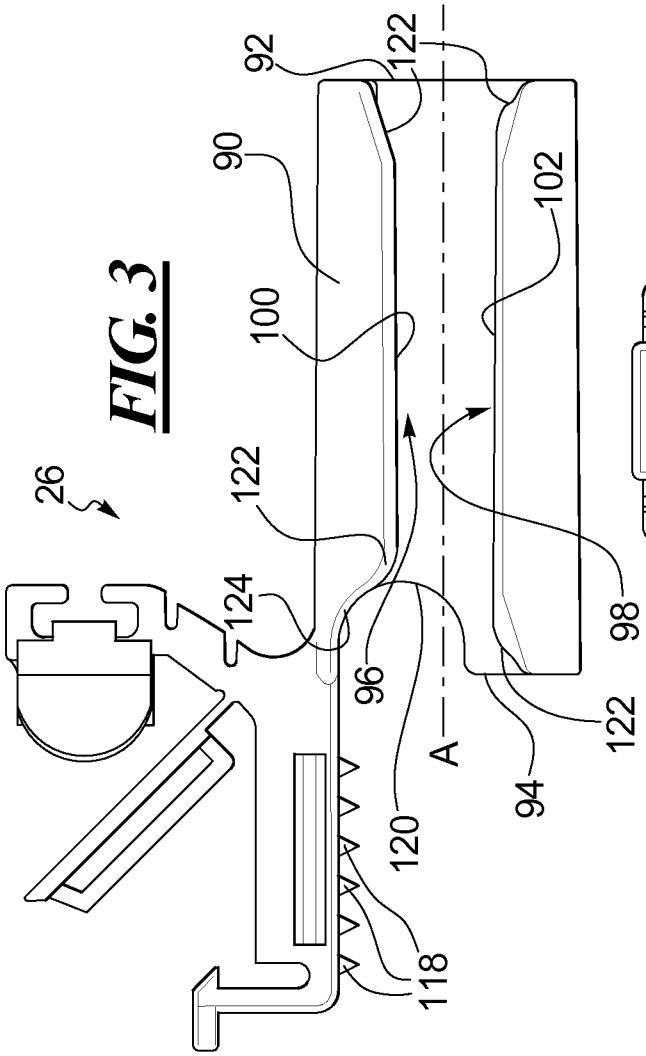

FIG. 3

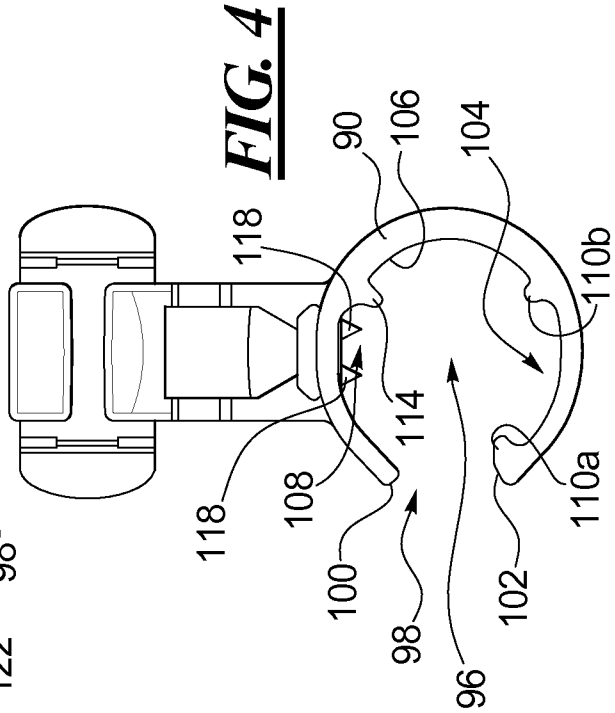

FIG. 4

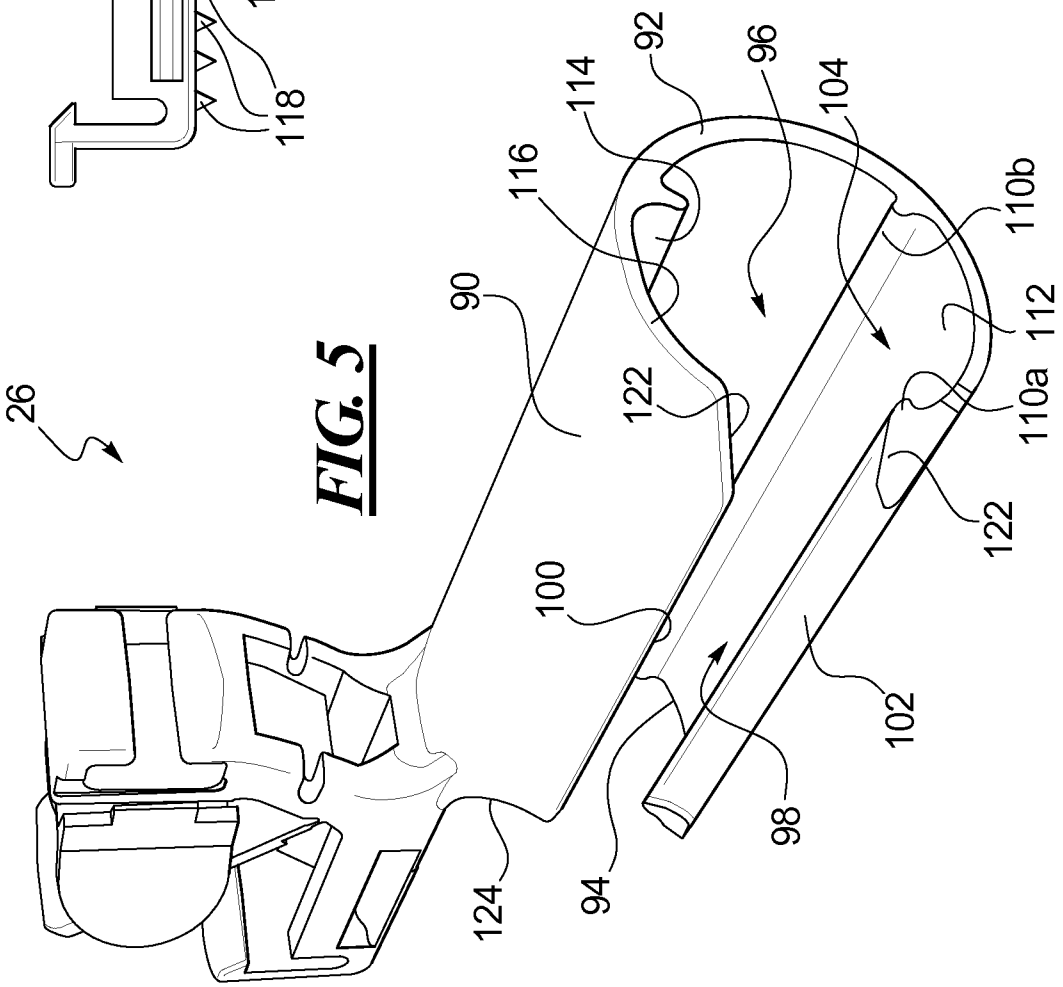

FIG. 5

FIG. 6

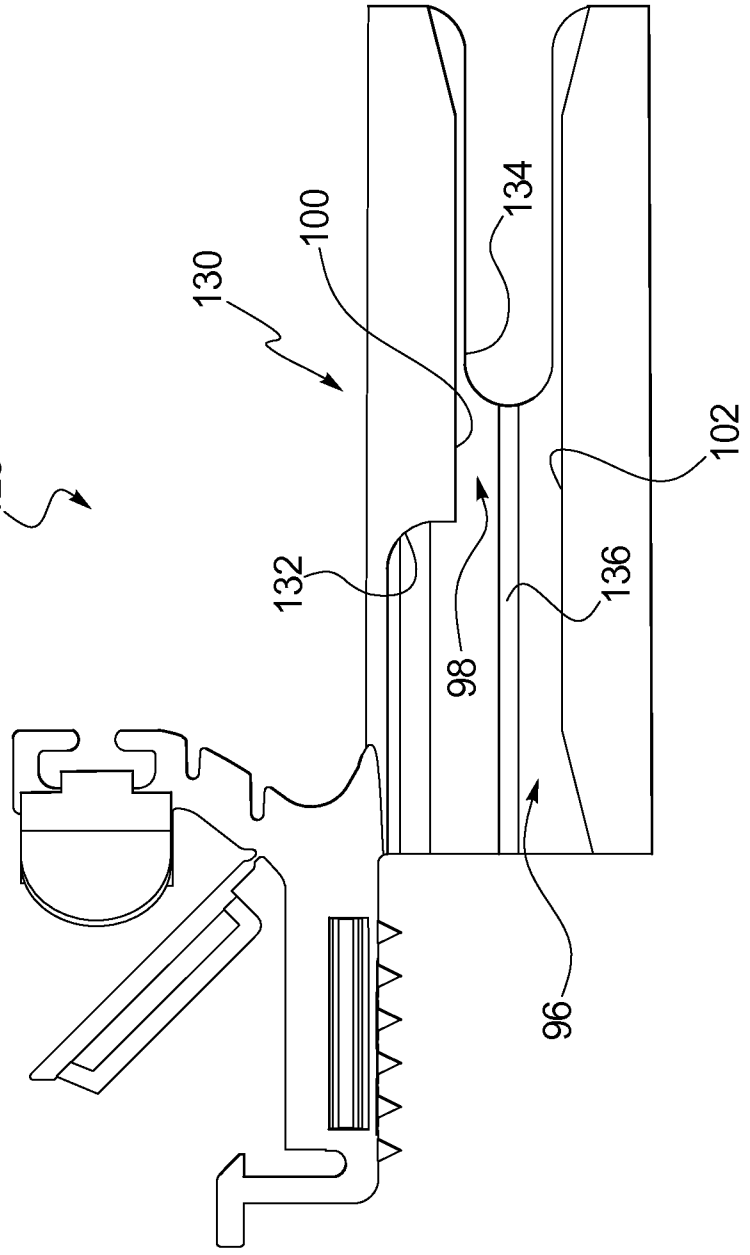
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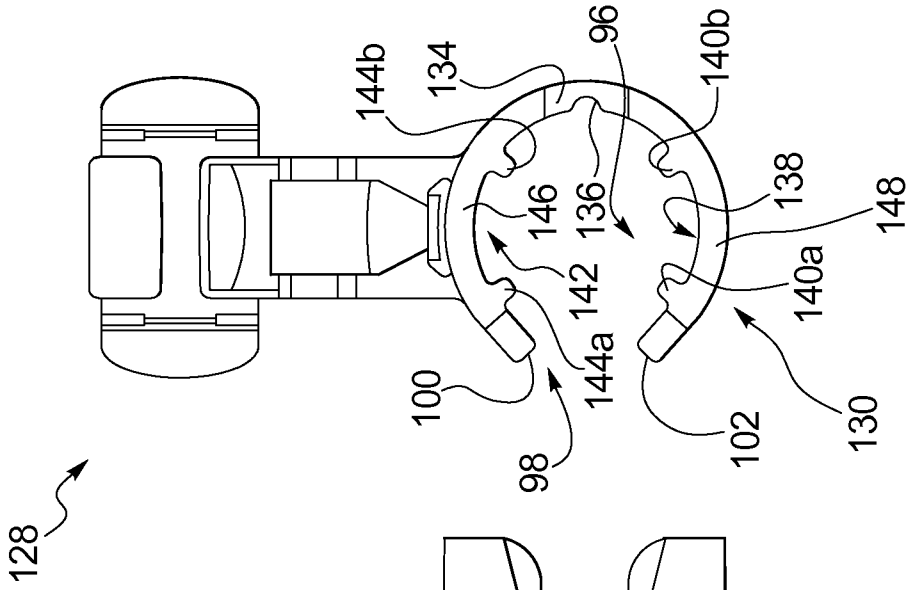
FIG. 7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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/017308

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61M16/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011/180065 A1 (HAJGATO JULIUS [CA] ET AL) 28 July 2011 (2011-07-28) paragraphs [0051] - [0054]; figures 1,4,5,8,10,12 paragraph [0039]; claim 1 paragraphs [0002], [0007] - [0019], [0034] - [0060]	1-18
X	WO 96/11029 A1 (SWEDISH SOPHISTICATED EXPORT I [SE]; OTTOSSON PAUL [SE]) 18 April 1996 (1996-04-18) page 3, paragraph 2; figures 6,6a,6b pages 1-4; figures 1-9	1-18
X	EP 2 481 436 A1 (GUERRA PHILIP B [US]; PRINCE PAUL R [US]) 1 August 2012 (2012-08-01) paragraph [0019]; figures 15,16	1-14

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 April 2015	29/04/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Loughman, John

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/017308

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Information on patent family members

International application No
PCT/US2015/017308

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